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UNITED STATES PATENT APPLICATION

FOR

TABLET INTERLOCKING MECHANISM

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TABLET INTERLOCKING MECHANISM

FIELD

[0001] Embodiments of the invention generally relate to the field of flat panel displays.

5 GENERAL BACKGROUND

[0002] Over the past decade, there has been increased demand for notebook computers, especially in light of their enhanced data processing capabilities. Operating from either external or portable power sources, 10 conventional notebook computers feature a display housing pivotally connected to a body. Typically, the display housing features a liquid crystal display (LCD) while the body features a keyboard and a secondary input device, such as a roller ball or a touch pad for 15 example.

[0003] In order to access the keyboard and view the LCD, a user places the body on a surface (e.g., the user's lap or a stationary surface) and opens the notebook computer by pivoting the display housing in an upward 20 angular direction away from the body. As a result, the user is able to access the keyboard and secondary input device as well as to read the displayed content from

the LCD. To close and transport the notebook computer after use, the user pivots the display housing toward the body and secures the display housing. Such pivoting may be accomplished by a hinge attached to a 5 rear surface of the body.

[0004] Due to the growing popularity of personal digital assistants and tablet computers, notebook computers are now being configured to alternatively operate as a tablet computer, with a stylus operating as the input 10 device. This requires the display housing to be inverted, namely the LCD is positioned to face upward and to rest against the body.

[0005] Japanese Patent JP07-049725 discloses a notebook computer that can have the display screen in a key 15 entry state or a pen input state. In the pen input state the display screen covers the keyboard. The display screen is generally parallel to and facing away from the keyboard. The display screen is supported by two arms that have offset hinge points causing the arms 20 to move into a parallel relationship as the display is rotated between the key entry state and the pen input state. One of the arms is fitted with a cammed lock mechanism that operates to lock the arm when the display screen is either the key entry state or the pen

input state thus holding the screen in either of those positions. The lock is released by rotation of the display screen to permit movement to the alternate screen positions.

5 [0006] Known electronic devices that allow the display to be pivoted to an alternate position for tablet type use may have various disadvantages. For instance, one disadvantage is that conventional display housings may employ two independent locking mechanisms, such as a 10 pair of locking pins to preclude rotation of the LCD and a lock to attach the display housing to the body casing. This may make the locking/unlocking procedure cumbersome. Moreover, independent locking mechanisms may increase overall manufacturing costs and increase 15 the potential likelihood of a structural failure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Features and advantages of embodiments of the invention will become apparent from the following detailed description in which:

5 **[0008]** Figure 1 is a perspective view of an exemplary embodiment of an electronic device placed in a CLOSED position.

[0009] Figure 2 is a perspective view of the electronic device of Figure 1 when placed in a NOTEBOOK position.

10 **[0010]** Figure 3 is a perspective view of the electronic device of Figure 1 when placed in a TABLET position.

[0011] Figure 4 is a perspective view of the electronic device of Figure 1 in the CLOSED position without the display support member.

15 **[0012]** Figure 5A is a schematic cross-section of an exemplary embodiment of the electronic device of Figure 1 placed in a CLOSED position.

[0013] Figure 5B is a schematic cross-section of the electronic device of Figure 5A when placed in a
20 NOTEBOOK position.

[0014] Figure 5C is a schematic cross-section of the electronic device of Figure 5A when placed in a TABLET position.

[0015] Figure 5D is a schematic cross-section of the 5 electronic device of Figure 5A engaging or disengaging the latch mechanism for a TABLET position.

[0016] Figures 6A and 6B are schematic cross-sections of another embodiment of an electronic device having multiple TABLET positions.

DETAILED DESCRIPTION

[0017] Embodiments of the invention set forth in the following detailed description generally relate to an interlocking mechanism for a flat panel display that provides dual fastening capabilities. Herein, at least one embodiment of the invention relates to an interlocking mechanism that enables a bottom portion of a display housing to become attached to a display support member of an electronic device in a first configuration and to become attached to a body of the electronic device in a second configuration.

[0018] In the following description, certain terminology is used to describe certain features of one or more embodiments. For instance, an "electronic device" is defined as a product with a flat panel display. In this detailed description, for clarity sake and for illustrative purposes only, the electronic device will be illustrated as a portable computer that can be alternatively converted between a notebook computer and a tablet computer. Embodiments of the invention may be utilized in a variety of electronic devices including, but not limited or restricted to personal digital assistants, cellular telephones, digital cameras, video cameras, navigation systems, and the like.

[0019] Herein, terms of geometric orientation and relationship such as "up," "down," "front," "back," "top," "bottom," "vertical," and "horizontal" are used in a conventional sense as would be applied to a particular device in a typical operating orientation or as may be shown in the Figures. It will be appreciated that embodiments of the invention may be used with small, portable devices that may be readily placed in any of a wide variety of overall orientations and that such devices may have more than one typical operating orientation. Changes in the overall orientation of a device will, of course, alter the terms of geometric orientation and relationship that would be applied to the device in any given overall orientation. Terms of geometric orientation and relationship are used herein for clarity of description and should not be read as restrictive on the broad aspects of various embodiments of the invention.

[0020] Herein, the terms "rotate," "pivot," as well as varying tenses thereof are generally defined as an angular movement about an axis of rotation. The axis of rotation may be fixed relative to the overall orientation of the device. For this detailed description, the terms "vertically pivoted" (or any tenses thereof) generally relates to a rotation along a

substantially horizontal axis of rotation. The term "horizontally pivoted" (or any tense thereof) generally relates to a rotation along a substantially vertical axis of rotation.

5 [0021] Figures 1-3 illustrate perspective views of an exemplary electronic device 100 placed in various positions. In particular, Figure 1 shows a perspective view of an exemplary electronic device 100 placed in a CLOSED position. Figure 2 shows a perspective view of 10 the electronic device 100 placed in a NOTEBOOK position. Figure 3 shows a perspective view of the electronic device 100 placed in a TABLET position wherein the back display panel 114 of the display housing 110 is adjacent the front panel section 122 of the body 120. The features and components of the 15 electronic device 100 will be referenced based on a collective review of Figures 1-3.

[0022] Implemented with an embodiment of an interlocking mechanism as described below, electronic device 100 20 comprises a display housing 110 that is pivotally coupled to a body 120 through a first and second hinge assemblies 130, 150 and a display support member 140. It is contemplated that different areas of the display housing 110 and the body 120 may be of different

materials. For example, a portion 123 of a front panel section 122 of the body 120 surrounding a secondary input device 185 may be of stainless steel or another metal composition rather than hardened plastic to 5 improve durability in prolonged use.

[0023] In one embodiment of the invention, the body 120 may comprise two main panel sections, namely the front panel section 122 and a back panel section 124. These panel sections 122, 124 may be brought together to 10 enclose hardware components and stored software of the electronic device 100. This provides protection against foreign materials and environmental conditions. In this embodiment, the panel sections 122, 124 may be made of non-pliable material such as hardened plastic. 15 The body 120 has a bottom edge 126 and an opposing top edge 128.

[0024] The electronic device 100 may further comprise a keyboard 180 integrated into the body 120. A secondary input device 185, such as a touch pad or a track ball 20 for example, may be integrated into the body 120 as well. In one embodiment of the invention, dual speakers 170 and 172 may be integrated into the body 120 adjacent the bottom edge 126 and separated by the display support member 140. The speakers 170, 172 may

be substantially visible when the display housing 110 is placed in the CLOSED position.

[0025] The display support member 140 has a first end 142 and an opposing second end 144. A first hinge assembly 130 may pivotally couple the first end of the display support to the body 120 adjacent the bottom edge 126. In one embodiment of the invention, the first hinge assembly 130 may be configured to pivotally couple the bottom edge 126 of the body 120 and the first end 142 10 of the display support member 140.

[0026] The display support member 140 may be coupled adjacent to the bottom edge 126, meaning that the first hinge assembly 130 may rotate about a substantially horizontal axis of rotation that is in the plane of the bottom edge 126 or somewhat forward or backward from 15 that plane.

[0027] In one embodiment of the invention, the axis of rotation for the first hinge assembly 130 may be several inches forward of the bottom edge 126. This 20 may provide a rear portion of the body between the horizontal axis of rotation of the first hinge assembly 130 and the bottom edge 126 of the body 120. The rear portion of the body may accommodate some of the

hardware components in the body 120, for example speakers 170, 172.

[0028] In one embodiment of the invention, the first hinge assembly 130 may provide a brake mechanism, such as a torsion bar mechanism or a frictional hinge, in order to maintain display housing 110 at a selected angle of rotation above body 120 when the device 100 is opened in NOTEBOOK position. For instance, the first hinge assembly 130 may be adapted to maintain display housing 110 at an angle A, where "A" typically ranges between approximately 30 degrees and 150 degrees (see Figure 2).

[0029] The display housing 110 houses a flat panel display 111. In one embodiment of the invention, the display housing 110 may also house all or part of the circuitry for generating a displayable image on the flat panel display 111. Examples of flat panel displays 111 include, but are not limited or restricted to a liquid crystal display (LCD), a plasma display, or the like.

[0030] The display housing 110 may comprises two panel sections coupled together. These panel sections may include a front display panel 112 and a back display panel 114. The flat panel display 111 may be housed such that a display surface of the flat panel display

111 is visible in the front display panel 112 of the display housing 110.

[0031] Herein, the display housing 110 has a top edge 118, which is the edge that is substantially adjacent the 5 top edge 128 of the body 120 when the display housing 110 is placed in the CLOSED position (Figure 1). Moreover, the flat panel display 111 is adjacent the front panel section 122 of the body 120.

[0032] When the display housing is placed in the CLOSED 10 position (Figure 1) or in the NOTEBOOK position (Figure 2), the display housing 100 has a bottom edge 117 situated substantially adjacent to the bottom edge 126 of the body 120.

[0033] Alternatively, the bottom edge 117 of the display 15 housing 110 may be placed substantially adjacent the top edge 128 of the body 120 when the display housing 110 is placed in the TABLET position (Figure 3). In the TABLET position the back display panel 114 is adjacent the front panel section 122 of the body 120.

[0034] Figure 4 is a perspective view of the electronic 20 device 100 of Figure 1 in the CLOSED position without the display support member 140 to allow certain aspects of the display housing 110 to be illustrated. The back

display panel 114 may include a recessed area 115 that is sized to accommodate the display support member 140 (not shown). This recessed area 115 enables a top surface 116 of back display panel 114 to be 5 substantially coplanar with a top surface 141 of the display support member 140 when the electronic device 100 is in the CLOSED position (see Figure 1).

[0035] As shown in Figure 1, second hinge assembly 150 may 10 pivotally couple the second end 144 of the display support member 140 to the display housing 110. In one embodiment of the invention, the second hinge assembly 150 may be generally positioned adjacent a longitudinal center 151 of the back display panel 114 of the display housing 110, meaning that the second hinge assembly 150 15 may rotate about a substantially horizontal axis of rotation that is approximately equidistant from the back edge 117 and the front edge 118 of the display housing 110. The axis of rotation may be in the plane of the back display panel 114 or somewhat above or 20 below that plane.

[0036] The portion of the display housing 110 between the longitudinal center 151 established by the second hinge assembly 150 and the first hinge assembly 130 is referred to as the "bottom portion" 119 of the display

housing 110. The second hinge assembly 150 enables the display housing 110 to be vertically pivoted around the horizontal axis of rotation established by the second hinge assembly 150. The second hinge assembly 150 may 5 be a friction hinge, a collection of friction hinges, or one or more hinges without a brake mechanism.

10 [0037] Returning back to Figure 4, the back display panel 114 may comprise a recessed portion 152 adapted to receive the second hinge assembly 150. The recessed portion 152 may be in the recessed area 115.

15 [0038] As further shown in Figure 4, the display housing 110 may comprise one or more first latch members 113, such as latch hooks, coupled to the back display panel 114 adjacent the bottom edge 117. The first latch members 113 may be positioned within the recessed area 115.

20 [0039] The arrangement of the display support member 140 and the hinge assemblies 130, 150 may permit the display housing 110 to be placed in various configurations with respect to the body 120. Figure 5A is a schematic cross-section that shows the display housing 110 placed in the CLOSED position. Figure 5B is a schematic cross-section that shows the display housing 110 placed in the NOTEBOOK position. Figure 5C

is a schematic cross-section that shows the display housing 110 placed in the NOTEBOOK position. The features and components of the electronic device 100 will be referenced based on a collective review of 5 Figures 5A-5C.

[0040] As shown in Figure 5A, the display support member 140 may comprise one or more second latch members 220 coupled to the display support member 140 adjacent the first end 142. Each first latch member 113 may engage 10 one of the second latch members 220 to couple the display housing 110 to the support member 140 and prevent rotation of the second hinge assembly 150. This provides a first configuration of the device 100 in which the display housing 110 may be moved from the 15 CLOSED position (Figure 5A) to the NOTEBOOK position (Figure 5B) by rotating the display support member 140 and the coupled display housing 110 about the first hinge assembly 130.

[0041] A first storage latch member 160 may be provided on 20 the display housing 110 adjacent the top edge 118. A second storage latch member 162 may be provided on the body 120 adjacent the top edge 128. The first storage latch member 160 may be coupled to the second storage latch member 162 prevent rotation of the first hinge

assembly 130 and maintain the device 100 in the CLOSED position as shown in Figure 5A. The first storage latch member 160 may be uncoupled from the second storage latch member 162 to permit rotation of the 5 first hinge assembly 130 and to allow the device 100 to be opened to the NOTEBOOK position as shown in Figure 5B. In one embodiment of the invention, the first storage latch member 160 may be rotatable as shown in Figure 5B.

10 [0042] The first latch member 113 may be uncoupled from the second latch member 220 to permit rotation of the first hinge assembly 130 and to allow the device 100 to be placed in the TABLET position as shown in Figure 5C. In one embodiment of the invention, the second latch 15 member 220 may comprise a slidable button with a resilient member 154, such as a spring, to urge the second latch member toward a position that engages the first latch member 113. The slidable button may be moved in opposition to the resilient member 154 to 20 uncouple the first latch member 113.

[0043] The body 120 may comprise one or more receiving portions 191 included in the front panel section 122 adjacent the top edge 128. In one embodiment of the invention, one or more channels 190, 192 are formed on

the front panel section 122 (see Figure 1). Each channel 190, 192 includes a recessed area for the receiving portions 191, 193 where one of the receiving portions is further shown in Figures 5A-D. As shown in 5 Figure 5C, the first latch member 113 may engage the receiving portion 191 when the device 100 is opened to the TABLET position.

[0044] As shown in Figure 5D, the display housing 110 may require a substantial rotation away from the TABLET 10 position before the first latch member 113 may move sufficiently away from the receiving portion 191 to uncouple the first latch member 113 and allow the display housing to move freely away from the body. In this way, the first latch member 113 may be reliably 15 coupled to the receiving portion 191 without requiring the first latch member or the receiving portion to be independently movable.

[0045] In one embodiment of the invention, the first storage latch member 160 may be rotatable to engage a 20 third storage latch member (not shown) coupled to the body adjacent the bottom edge 126, as shown in Figure 5C. Coupling the first storage latch member to the third storage latch member may further secure the display housing 110 when the device 100 is in the

TABLET position. The rotation of the first storage latch member 160 may provide an unobstructed surface on the front display panel 112 in the TABLET position.

[0046] In one embodiment of the invention, two or more receiving portions, for example three receiving portions 191, 191', 191" may be provided for each first latch member 113'. The additional receiving portions 191', 191" may be placed a successively greater distances from the top edge 128 of the body 120. This may permit the display housing 110 to be secured at various angles relative to the body 120 when the device is in the TABLET position as shown in Figures 6A and 6B. This may allow the display housing 110 to be coupled to the groove 190 on the front panel section 122 of the body 120 with the display housing at any of 15 at least two inclined positions.

[0047] In one embodiment of the invention, the first latch member 113' may be a pawl mechanism that permits the first latch member to adapt to two or more receiving portions 191, 191', 191" with the display housing rotated by different amounts when engaged with each of 20 the receiving portions. A resilient member 118 may urge the pawl mechanism 113' to rotate away from the display housing 110 to facilitate engagement in the

various receiving portions 191, 191', 191". The resilient first latch member 113' may allow the first latch member to deflect when not engaged with a matching latch member.

5 [0048] While certain exemplary embodiments have been described and shown in the accompanying drawings, it is to be understood that such embodiments are merely illustrative of and not restrictive on the broad aspects of various embodiments of the invention, and 10 that these embodiments not be limited to the specific constructions and arrangements shown and described, since various other modifications are possible.